



MNCs Strategies and their linkages with SMEs¹

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Abstract

This chapter analyses the Multinationals corporations in Mexico, particularly their linkages with small and medium enterprises. Mexico has been an important magnet of foreign direct investment (FDI), particularly during the last forty years of the last century. The FDI has played a very important role in Mexico economic growth, particularly in manufacturing exports. But since the mid eighties the Mexican economy had change deeply from an import substitution model to export platform.

The FDI has important presence in many different sectors with a wide range of technology. Mexican multinationals have been developed as well. Although the exports and value add is highly concentrated in a few hundreds of Multinationals, Mexico's manufacturing is based on a broad platform of small and medium enterprises. The US has become the main investor, with its share of total FDI reaching almost two thirds of the total.

In spite the huge increase in exports, particularly since NAFTA, the economic growth has been quite mediocre. This performance is even worse when compared the 2001-2004 periods to its primary trading partners and competitors. Investment amounts have decreased considerably in the new Millennium. During 2000-2003, it went from being close to 17 billion dollars down to 10 billion. Moreover, manufacturing and *maquiladoras*' share in the overall FDI has decreased from 9.4 million of dollars in 2000 to 4.7 in 2003. Several industries with different technologies in China are

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competing directly with Mexican exports in the US market.

The main pitfall of the model was the lack of supplier's development and the heterogeneous nature of businesses; the consequence was production disintegration, which led to a continuous rise of the import coefficient increasing the dependence for foreign investment to finance foreign exchange demand. Nevertheless, there are some regional cases that show evolution in terms of local development and industrial upgrading.

1. INTRODUCTION

One aim of developing countries has been to foster growth through the development of linkages between foreign and domestic firms; this has increased the competition among them to get the most foreign direct investment as possible. In the period 1990 to 2004, inflows of FDI into the three main developing areas East Asia, Latin America and Sub-Saharan Africa reached 1.5 trillion dollars 46.8% going to Latin America, 46.5 to East Asia and 6.8 to Africa. But the larger impact of this investment has gone to East Asia where this sort of investment has helped to foster its economic growth.

Difference in paths has emerged due mainly of how each country has been able to promote interactions with FDI. Asians have been able to push a learning process taking the best from foreigners and incorporating into a local innovation process, this has led to a virtuous circle allowing high rates of growth and the improvement of standards of living. Other regions had not followed the same path; they have been more passive to foreign investment, focusing on the use of technology for production, with little adaptation and almost no innovation. Latin America has been one of those cases, where the lack of entrepreneurship and of industrial policy has led to the underutilization of human capital. Competitiveness continues to be based on the cost paradigm rather than on innovation, and consequently, industrial complexes are very heterogeneous, with large gaps between large and small businesses in these countries. Productivity varies greatly among different sizes of businesses. The latest Economic Census in Mexico (2004) shows that micro businesses obtained US \$5,000 of value added per employed person a year, while large businesses, generally MNCs, obtained six times this value. This major difference is explained by multiple factors, but a key factor is the low level of accumulation of micro businesses. Their average assets were only US \$16,000, while large businesses had an average of US \$28 million. These differences have been increasing over time, and a virtuous circle has not emerged, has is expected.

Great expectations emerged in the 1980s and 1990s with the assumption that industrial reorganization on a horizontal basis would reduce the gap, through greater

subcontracting interactions among businesses of different sizes. However, advocates of this notion failed to consider the effects of increased globalization, since while subcontracting would increase, it would not necessarily take place within national borders, but rather at the global level. Complex interactions have increased with the emergence of global value chains, as many models of industrial reorganization are taking place within national borders and within global capitalism.

One of the main features of global capitalism has been increased capital mobility, as global firms search for the best locations to take advantage of cost differentials. This sort of practice leads to a very volatile factory location, as new investment remains in the same place for only a few years in some cases. This restriction reduces the possibilities for industrial reorganization within national borders. This is because the development of suppliers requires time, since it is a learning process, and upgrading is required to adjust to global standards. Market failure to adjust at the required speed makes this an area for government support. However, government intervention at a national level has been quite volatile, leaving the final outcome to be determined by the market.

The debt crisis of the 1980s pushed the country into industrial reorganization and into the quest for a new development model. It has been a long road, since the inward model of industrial organization was based on the principles of vertical integration, whereas practice and policy were focused on supporting Multinationals. Reorganization is taking place and interactions have developed, but the questions at the beginning of the 21st century are: how large are these interactions? And what are the linkages to the increased foreign direct flows that have taken place during the last twenty years? The first part of this paper focuses on the economic framework and how it has evolved; the second gives some examples of how some value chains have developed; and the third explores how the learning process has advanced and how interactions have developed and what sort of agenda is required to enhance the performance of small-medium enterprises (SMEs)⁴ in the 21st century. In this regard, the sub-regional institutions, public and private, have a tremendous role in the process of industrial upgrading.

⁴ In Mexico SMEs means from micro (1 to 15 employees) to medium (100 to 250).

2. ECONOMIC PROFILE

By many standards, Mexico is a very strong economy. In terms of total GDP, the combination of a population of 107 million and a per capita GDP of over US \$6,230 makes Mexico the tenth largest economy in the world. It is the United States third most important trading partner, after Canada, and it is competing with China, which has obtained second place. Economic liberalization has resulted in a dramatic transformation of both the quantity and structure of trade: from 1980 to 2004, exports increased twelve-fold and there was a major shift from oil-related to manufacturing exports. However, despite the huge increase in exports, economic growth has been quite mediocre since the 1980s. This performance is even worse when compared to its Asian and Latin-American competitors (Table 1).

One of the aims of NAFTA was for manufacturing to become the driving force of the economy. However, the behavior of the Mexican industrial complex has been below expectations. Take, for instance, the performance of what can be considered a symbol of NAFTA: *maquiladoras*. For at least two decades, the most dynamic part of Mexican manufacturing has been maquiladora industry in Northern Mexico. With annual growth rates between 10% and 12% up to October, 2000. Maquiladora base manufacturing has been one of the engines of regional employment and income growth since at least the mid-1980s. They registered yearly personnel increases for 37 consecutive years, and reached their maximum level of employment at 1.35 million in 2000. Yet, following November 2000, they shed 14% of their work force and 23% of plants closed. This could easily be dismissed as part of an adjustment from the contraction of the US economy. Yet, the underlying reasons are more structural than cyclical. An estimated 50% of the *maquiladoras* that left the country moved elsewhere, mainly to Asian countries —particularly China. As long as foreign firms are in Mexico for cost considerations, and there is little local content, firms will be footloose, migrating to lower cost locations as relative wages start to increase. Mexico is now at a crossroads: it cannot yet compete on the basis of knowledge assets (such as OECD countries), yet its traditional comparative advantage is eroded by low cost competitors (Carrillo, 2003). Nevertheless, there have been a processes of evolution in some sectors and especially in

some firms (called ‘generations of maquilas’) as well as co-evolution in regard with some suppliers and especially regional institutions (Carrillo and Lara, 2005; Casalet and Gonzalez, 2006; Dutrenit, *et al.* 2006), as we will see in this Chapter.

Manufacturing diversification has taken place in Mexico during the last fifty years, moving from a narrow base in the 1950s, to a more sophisticated manufacturing sector at the turn of the century. According to its technology profile by industry, technology and innovation (Malerba and Montobbio, 2000), intermediate technology and resource-based industries have dominated manufacturing performance, with low technology industries losing ground to high-tech industries.

Restructuring did take place within the sector and in two dimensions: first, in the composition of production (structural restructuring), and second, in terms of territory (spatial restructuring). Structural restructuring demonstrates the way in which Mexico has become more competitive in the global economy, as intermediate and high tech industries have been able to show more dynamic growth than resource based and low technology industries:

- The dynamics in resource based industries did not allow them to maintain their share in total manufacturing, mainly due to an adjustment in wood, oil products, food processing, and tobacco industries, in which little investment has been realized. Successful stories in this area were meat, dairy products, beer and soda-water processing industries that have been able to keep up with demographic expansion (24 million in the period from 1990 to 2005).
- The reduction in the share of low technology industries was due to the apparel industry, which faced a double track, including a low cost strategy⁵ that helped them to get into the international commodity chains (Gereffi 1994). A success story was “jeans production in the Laguna region” (Van Doreen 2003), however producers unfortunately did not take advantage of the export boom to transform themselves into design competitive industries.

⁵ The low cost strategy followed the 1982 debt crisis. The adjustment of the exchange rate led to price increases, however there was a delay in wage adjustments, leading to a continued lag in wages, which was used as a way to compete in world markets.

- The increase in the share for intermediate technology industries was mainly due to the auto industry, which increased its share from 3.1 to 7.8% of total manufacturing value added, as Mexico became the world's 11th largest auto producer. Regions such as Puebla-Tlaxcala or Hermosillo have been engines for local development and production capacity. Original Equipment Manufacturers (OEMs) and their foreign direct suppliers are forming industrial clusters.

In the high tech area, Mexico has attracted global electric and electronic producers in different areas: IBM opened a portable computer factory in Guadalajara creating a network of suppliers around it; Baja California (Tijuana and Mexicali) facilities for assembling TV sets attracted electronic components producers; the new digital television of LCD and Plasma, and new materials are taken place in Tijuana and Juarez; central Mexican states were able to consolidate household appliance production, etc. In addition to the electronics sector, there were new developments in the electrical machinery sector, and in surgical and medical instrument manufacturing. As a result of all of this, high tech industries have become the most dynamic among manufacturing industries.

The main pitfall of the 'Mexican model' was the lack of supplier's development. Disintegration was less severe in the intermediate technology industries, which were the ones to support the development of some value chains in different regions, creating cluster economies, mainly in the auto and electronics industries. The auto industry has a long history in Mexico. Assembly plants were opened in the 1950s and since then, it has been one of the key businesses in development policy. The value chain has continued to develop, and today auto and auto parts value added is at 15 billion, with 40% from auto and truck production, and the remaining from the auto parts industry.

Electric and electronics industries have also been able to develop a strong value chain in Mexico, where the most important activity is Electronic Component Manufacturing with a value added of US \$1.6 billion, followed by audio and video equipment manufacturing with US \$1.1 billion.

Mexico's manufacturing is based on a broad platform of SMEs that comprise 99% of total enterprises, and are concentrated in resource based and low and medium technology industries. Although the exports and value add is highly concentrated in a few hundreds of multinationals corporations.

The heterogeneous nature of businesses is the main problem facing SMEs in Mexico. Productivity is very low at the micro level, and increases with size, but such a large investment is necessary to obtain economies of scale (Table 2).

One of the main hypotheses that supported NAFTA enactment was that linkages would be developed and upgrading would take place through export activity, that is Multinational firms (foreign and domestic). Unfortunately, evidence shows that the main source of income for SMEs continues to be the domestic market and that only a few firms in this range have been able to enter into the export wave (Table 3). However the Table 3) does not count the *maquiladoras*. According with INEGI there were 2,783 plants in December 2006. All the plants export 100% of production (physically or virtually) to U.S., later a small percentage goes to other countries, even to Mexico. Also, Mexican multinational firms exist and apart from contributing to the exports, they have important investments abroad, fundamentally in Latin America, although some are truly global.

2.1 Recent Trends in Inward FDI

The FDI in Mexico has played a very important role in its economic growth, particularly in manufacturing exports. New investment flows jumped from an average of US \$1.6 billion in the 1980s, to \$5 billion in the 1990s, and to \$10 billion in the first four years of the 21st century. Under this expansion wave, FDI inflows accumulated during the period from 1994 to 2004, to reach US \$162 billion. Of this amount, 58% was composed of new investments, 17% reinvested profits, 12% inter-company accounts, and 13% imports of fixed assets by *maquiladoras* with foreign investment (Table 4).

Although the record of investment flows in recent years appears impressive, the data is actually relatively poor in comparison with other developing countries, especially with China. Despite Mexico's reduced capacity to absorb global flows, FDI has played a very important role over time in the national economy. In the period from 1960 to 1982, the role of FDI was to support

Nevertheless the role of Mexican exports has not changed, its position certainly has. Investment amounts have decreased considerably in the new Millennium. During 2000-2003, it went from being close to 17 billion dollars down to 10 billion. Moreover, manufacturing and *maquiladoras*' share in the overall FDI has decreased from 9.4 billion of dollars in 2000 to 4.7 in 2003. China, on the other hand, has managed to attract a considerable volume of FDI which represents 3.2 times higher than in Mexico in 2000 and 4.3 in 2002. Several industries with different technologies in China are competing directly with Mexican exports in the US market (Carrillo, 2005)

2.1.1 Principal Origins of Foreign Investors and type

The US has become the main investor, with its share of total FDI reaching almost two thirds of the total. Spain has become the second largest with 9.4%. It owns two of the largest financial groups in the country (BBVA Bancomer and Santander-Serfin), and it has investments in the food and apparel industries, and in the service sector, mainly tourism and software. The Netherlands is the third largest with almost 8%, followed by a group of medium size investors including Germany, the United Kingdom and Switzerland. For their part, Asian investors have a long history in Mexico (Figure 1).

Most foreign investors in the last ten years have come to take advantage of NAFTA. On the average the most suitable areas of investment have been intermediate and high tech industries, in which three quarters of accumulated investment are concentrated. This pattern has not been homogenous among countries, however. Specifically, the US has concentrated its investment mainly in the auto, electronics, and apparel industries —

areas in which low wage subcontracting has helped American firms to decentralize in North America. Most intermediate and high tech industries are export oriented, and only a share of production goes to domestic sales. For example, auto production in 2004 was 1.5 million units, and 1 million of them were exported. Also, in the electric and electronic industries, most production is also export oriented, as in the television assembling industry at the border where is in an important technological mutation⁶. Mexico produced 68% of total television sets sold in NAFTA in 2003, and the United States concentrated 60% of the consumption in the region (Carrillo 2005).

Although FDI from U.S. has a key role in Mexico the process is not homogeneous. The principal exports products leading by foreign investors (MNCs) had been a heterogeneous performance. Figure 2 show while vehicle sector, electronic appliances and machinery industry have been change positively during 2000-04 period, others such as TV or telecommunications has decrease dramatically.

2.1.2 Important Location Factors: Clusters of foreign Direct Investment

The matter of space is embedded in all FDI decisions. In the first stage of FDI expansion in which the domestic market was the driving force, the central region of Mexico became the ideal location for foreign investors, since almost half of the population is concentrated in eleven of the thirty-two states of Mexico, with a total of 47 million people. Public expenditures developed infrastructure networks around the region, enhancing investment conditions. And therefore, the first FDI wave was located in that region, with production clusters developed in specific areas. The second wave of FDI, which was focused on developing an export platform, was located in the US-Mexican border states, pushing development into the northern states, but unable to develop linkages with former operations in central Mexico. Between 2000 and 2004, the relative export share of Mexico to USA plummeted from 10.9% to 10.3%. The case of auto industry is very illustrative in this sense. Also the regions that FDI had been selected are linkage with the cluster product exports (jeans in Torreon, TVs in Tijuana,

⁶ The analog color television has entered in its aging phase and the digital televisions (known by their technology like LCD and Plasma) are beginning their phase of growth (Carrillo 2006).

wire harnesses in Juarez, lap tops in Guadalajara, shoes in Leon, software in Monterrey, etc.).

3. POLICY APPROACHES FOR FDI-SME INTERACTION

Overall approach adopted by the government

Trade policy became the core of the new industrial policy, with no place for subsidies. This opened the door to horizontal policies, with entrepreneurship and deregulation as the main axis. The policy became quite successful in terms of promoting an export platform, which pushed export value from US \$18 to US \$187 billion during the period from 1980 to 2004. The main challenge facing the export model is the development of linkages among export firms and the rest of the economy.

In response to the shortcomings of the trade-based policy, a new approach was designed at the turn of the century: the development of clusters based on greater promotion of SMEs, entrepreneurship, regional vocations and the selection of priority industries (auto, electronics, software, aeronautics, textile and apparel, chemical, shoes and leather industries, among others). The main feature of the new approach has been to increase expenditures on promotion, with the budget for financing SMEs increasing from US \$22 million to US \$170 million in the period from 2000 to 2005, and reaching 345,000 small businesses.

To support regional and industry linkages, governments at different levels have developed hub centers (*Centros de Articulacion Productiva*) whose main goal is to strengthen value chains. Here some examples by industry and region:

The fiber-textile-apparel value chain. In order to redesign the value chain and challenge the Chinese imports, an agreement was reached with the private sector, for the creation of nine “Design Centers” in La Laguna (where the largest jeans operation is located), Mexico City, Yucatan, Jalisco, Hidalgo, Aguascalientes, Puebla and Tlaxcala. Within the same policy package, there is a “Suppliers Development Program” where private

counselors certified by the government contact businesses to help them develop suppliers. Consultancy packages include promotion, diagnosis, interaction, design of improvement plan, and supplier's development. In 2006 12 firms have signed an agreement, although government officers have contacted more than 4,515 businesses.

Software and electronic industry. The launching of a system of business accelerators partnership with Silicon Valley, California is an interesting model. In the latter, twenty-five small Mexican IT companies from Baja California hope to use San Jose as a springboard to the technology market in the US and eventually around the world. Also in the auto industry has been focused on the promotion of first tier Mexican local supplier's near-shore to OEMs, especially those working in high specialized services. The Baja California organization, TECHBA, operates also in Montreal (multimedia & aerospace sectors), Phoenix (biotechnology & aerospace) and Detroit (auto industry).

Nuevo Leon State. This is a brown field site with a long tradition in heavy industry. The region have multiple and strong universities capabilities. The Monterrey Institute of Technology (ITESM) is one of the famous universities in Mexico with a strong entrepreneurial capabilities and leadership in Latin America MBA programs. Recently, the Nuevo Leon Sate has developed an important Park of Research and Technological Innovation. It has 70 hectares and 80-90% of the facilities are research centers. The objectives are: to link the research and innovation of the academic sector to facilitate the technological transfer to the productive sector; to attract international companies with technological base; to create high value jobs; to incubate business guided to new technologies; to foment the economic development by means of the commercialization of new technologies. Nine universities (R&D academic centers in engineering, advanced materials, etc.) and a cluster of 42 TI firms participate in this Park initiative.

Baja California State. In the case of Baja California a clear co-evolution process has been presented, between the development of the industries and the institutional upgrading. A true explosion of public, private and mixed institutions was developed starting from the years ninety (Villavicencio, 2006). A good example is *PRODUCEN* (Carrillo and Moloman, 2008) who born with the purpose of developing suppliers for the electronics. It acts as a broker to facilitate the interaction among the companies, the

research institutions and the public sector. They participate in the project definition with a vision of long term for the whole State, starting from to understand and to analyze the capacities, the inhibitors and the latent opportunities in the market. In particular, (a) it develops the strategic plans of the key industries and it impels the execution of the derived projects. (b) It articulates the efforts of the government and educational institutions, business associations so that they offer a better atmosphere for the business. And (c) it collaborates with other instances for economic, industrial and technological development. It operates in different sectors: display devices, medical, autos, aerospace, biotechnology, semiconductors, IT, metal mechanics and plastics. The cluster of medical products is the best example of a 'Triple Helix Model' for the State and involves research centers, SMEs, multinationals and public and private agencies (www.producen.org). Also, the promotion of dozens of business meetings had been arrived to a concrete projects. The most recent is the Technological Consortium that brings 5 national research centers to the region in order to be linked with innovation processes and productive development.

Assessment of its effectiveness

Policy effectiveness can be measured against the main goal that was initially pursued, and on that basis, industrial policy models have been successful at different stages to promote capacity creation, product diversification, and export capacity creation. However, the Mexican model has failed to move up⁷ the ladder through an innovation policy. In the overall economy, R&D expenditures have remained around 0.40% of the GDP in the 2000-2005 period. Although few firms have a research department or have developed linkages with research centers, this process is changing; unfortunately not with the necessary speed. The existence of success MNCs cases such as Delphi in the auto parts sector in Juarez, IBM in the electronics in Jalisco, or Softech in the software industry in Monterrey, shows that some big firms are making important R&D investments. In the case of *maquiladora* industry (where multinationals firms are located) more than 20% of the 298 plants in the three cities of the north of Mexico carry out R&D activities and have frequent and substantial innovations, and 11% have

⁷ The process has taken too much time and is not well diffuse neither throws the industries nor the regions.

developed patents (Carrillo and Gomis, 2005). This process has been accompanied by national business organizations and regional government agencies. In that sense regional systems of innovation are trying to develop in different regions of Mexico.

3.1 Electronic Cluster: first and second wave of procurement development

The electronics industry has developed in the Mexican economy under the patronage of transnational corporations that took advantage of local low cost operations under the *maquila* scheme, developing local sources for procurement on a limited base. It began to develop under ISI, with household appliances in central Mexico, followed by the Northern Border States, when the *maquila* program was launched in the 1960s. Today this phenomenon is all around the country, as can be observed in Map 1. The most advanced case is Jalisco. According with Rivera Vargas (2003) the collaboration and interaction of constituencies within the framework of Triple Helix Model, being the participant industry a foreign factor, can give place to knowledge creation, innovation and therefore capitalization of knowledge strengthening the electronics industrial cluster in the so called Mexico's Silicon Valley. Rivera Vargas (2003) found that, with the exception of one research and graduate education institute in 1988 associated with IBM, there was lack of backward and local linkages. The author found no joint applied research projects, no co-publications and no patents were detected, so a very important link was missing. One of the reasons for the absence of cooperative projects in applied research between the foreign electronics firms and the local higher education and research institutions might be that the foreign corporations chose the option of building their own research facilities (Rivera Vargas, 2003). Fortunately, this process has been change. The best example is the Advanced Program in Electronics Design and Software, which main objective is, in the first phase, to train 500 high qualified and world class electronic designers in a term of 5 years. In this program INTEL has invested about 500,000 US\$ in cutting edge equipment and the Jalisco State Council for Science and Technology (COECYTJAL), founded and financed by the government, is in turn providing the funds for the educational program and the scholarships for the students. In the second program the main objective is to consolidate at least 30 entrepreneurs in two years. The planned specific participation of INTEL in this program is to invest between 1 – 4 millions of US dollars (Rivera Vargas, 2003).

As a result of the innovation regional system, the electronics cluster of Jalisco is now composed of: 13 OEMs, 17 Contract Equipment Manufacturers, more than 400 Specialized Suppliers, 27 Design Houses, 19 of which are small companies, and 151 small firms dedicated to software development (Medina Gómez, 2007). In sum, the Jalisco case illustrates how the Triple Helix Model have begun to address problems in the electronics cluster of Jalisco and has played a very important role in the change of nature of this industry, that is, it has set off the transformation from assembling and manufacturing functions (first wave) to functions of design (second wave) in the electronics industry.

Television Industry and its upgrading process

Television producers have been winners in the trade opening and industry deregulation in Mexico. The television industry has attracted important flows of FDI under the *maquila* program. The number of televisions shipped from Mexico to the United States grew from 1.7 millions in 1987 to over 25 millions in 1998.

The growth of the TV sector in Mexico has been a direct result of the changes in this industry in the U.S. Towards the mid-80, European and mainly Asian MNCs forced most U.S. producers to abandon this sector. From 14 plants located in U.S., 10 were moved to Mexico under *maquila* program. Thomson purchased the General Electric and RCA plants, Philips bought Sylvania and Magnavox trademarks. Matsushita purchased Quasar. LG Electronics later bought all Zenith operations. This produced a television industry mainly divided among European MNCs with production plants in the United States and a rapid growth of mainly Japanese MNCs that invested in the creation of a television cluster in Tijuana. Figure 3 shows the current basic structure of television industry clusters in Mexico in which the participation of two Mexican states bordering with the United States stands out: Baja California (with 19 million of TV units plus 6 million of monitors in 2003) and Chihuahua (10 million of TV sets).

Seven out of every ten color television sets sold in the U.S. market in 1996-1999 were produced in Mexico by less than 10 OEMs located in Tijuana, Mexicali and Ciudad

Juarez. Around 110 electronic plants (OEMs and suppliers) have currently been established on the northern border (Figure 3), many of which assemble televisions and components from Japanese, Korean, Taiwanese, European and U.S.A. firms. In the year 2000, the television complex in the north of Mexico employed over 90,000 workers, including more than 10,000 technicians and engineers, and produced close to 30 million televisions per year (Contreras and Carrillo, 2002).

The sustained growth of the TV Industry in Mexico is a result of MNCs' high international competitiveness. These OEMs evolve from traditional assembly activities to more sophisticated manufacturing operations, such as high quality production, development and design. Television OEMs in Tijuana, for example, have been through deep modifications in product complexity, subsidiary autonomy, design activities, human resource use and plant organization. Taken into account two previous studies in 1998 and 2001, we can observed that: (a) the participation of Mexicans in top management has increased; (b) subsidiary autonomy in respect to the parent companies has grown; (c) there is an emphasis on design activities; (d) automation has grown; (e) technological levels have increased ("comparable to the highest world wide level" in some firms), and (f) certification of quality and environmental processes has increased. New activities such as financial and administrative management and technological information have been through deep changes. Since 2002 new changes have been developed: new assembly lines (digital assembly, automatic insertion for digital circuit boards), new activities such as distribution of the product, and reorganization of space⁸ (Carrillo, 2005).

A good example of Triple Helix Model is Sony. This company with a long tradition of design and vertical integration in Tijuana, is working now with two national research centers (CIQA, UTT), a public-private institution (PRODUCEN) and government agency (CONACYT) in order to develop new process technologies of plastics and substitute the traditional plastic frames for new bio resins.

Other case is the key components-television sets OEMs value chain in Baja California where *PRODUCEN* has developed a strategic analysis in order to support specialized

⁸ Cells production are techniques for reduced lead time, and reduction of lay outs.

product market niches, and stimulated the networking with universities and government support based on product-technology life cycle. Two research institutes (*CICESE and CITEDI*) lead by *PRODUCEN* established a *diploma*-training program for engineers. These activities landed in an updated the electronic engineering curricula of Baja California State University.

3.2 Between electronics and the automobile industry: The Delphi case.

During the past 20 years, Mexico's automobile industry has been subjected to intensive transformations within the framework of a complex reorganization of production and markets in the North American region. Three decisive aspects of this process are: a) regionalization of production networks run by major corporations in the context of growing market globalization; b) an organizational and technological transition to modular manufacturing that has had crucial repercussions for the organization of assembly plants, and particularly, supply chains; and c) subcontracting of ever larger segments of the manufacturing process, which the original equipment manufacturers delegate to their first-line suppliers. The overall effect of these industry trends is reflected in an intensive technological restructuring in firms' organization and in their relationships with their suppliers. The auto parts sector stands out for its economic role and, in particular, for the evolution process, like it is the case of Delphi -- the biggest global supplier for the car industry, with core competencies in integration systems and electronics.

Mexico plays a very important role for the Delphi (Lara and Carrillo, 2003). One third of employment is located in Mexico, and the volume is higher than in U.S. Of the 69 establishments in the Packard division, 65% were located in Mexico, and 34% in the U.S. and Canada. Delphi is the third Mexico's largest private sector employers. By year 2000 has close to 80,000 workers at 66 plants in 13 states. All Delphi's divisions are located in Mexico and the biggest worldwide Delphi's R&D facility is located in this country. The division of Delphi with the largest presence in the country is Packard Electric (the most intensive labor division) with 45 plants.

Together, the various divisions of Delphi produce roughly forty different products in Mexico.

Delphi's purchase from Mexican suppliers jumped from \$37 million in 1997 to \$300 million in 2000. The way Delphi's history evolved can be reconstructed in two stages, with one period from 1978 to 1994, and a second period from 1995 to 2002, according with the beginning of operations of a technical center in Juarez in 1995, modifying the way in which coordination was carried out among the Delphi divisions located in Mexico (Carrillo and Lara, 2005).

Delphi is the main employer of engineers in Mexico, and it has established consequently diverse agreements with universities, technology institutes, and technical schools, for equipment support, training programs, updated the curricula, as well as research projects. There are several cases of start-ups based on the labor experience in Delphi. New creation of firms in the machine-shops sector, as well as IT companies, plastic injection and even MEMS⁹.

3.3. The supplier development in the automobile industry: The Ford' case.

Mexico's automobile industry has been based on clusters of MNC operations (Map 2). The government's assumption has been that businesses can develop backward linkages, and with them, a learning process. Subcontracting has evolved gradually. The Mexican automotive industry has the capacity to produce about 2.0 million cars per year, including passenger cars, buses and trucks. There are 9 passenger car firms' manufacturers and 12 bus/truck assemblers. The number of auto parts manufacturers is between 500 and 600 of which 110-150 firms are presumed to be OEM suppliers.

In Hermosillo, Sonora for example, the productive capacity of Ford was increased from 120,000 to 300,000 annual vehicles, thanks to a new system of manufacturing was established, and the network of the first tier suppliers was reorganized in order to

⁹ MEMS = Micro-Electro-Mechanical Systems. MEMS is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology.

manufacture new models according with a modular system. All these aspects position this plant in the technology frontier of the vehicle industry¹⁰ (Contreras, 2006).

In July of the 2005 Ford Motor Company renewed their operations of the stamped and assembly plant in Hermosillo, after an ambitious expansion and reorganization process. A new system of flexible manufacture was established, and the network of first tier suppliers was reorganized in order to manufacture the new models according with the modular system. All these aspects position this plant in the technology frontier of the vehicle industry.

The investment to enlarge the Ford plant and to build a new park of suppliers overcomes the 2 billion dollars, the biggest investment in the car industry in North America in the last 5 years. Within, the Ford-Hermosillo becomes a plant of flexible manufacture able to produce up to 10 different models in a platform call CD3. Investments made by Ford and its suppliers have sparked new initiatives for the continuous development of innovation projects, both related to products & processes, and to services. These opportunities can be taken advantage of by current suppliers as well as by new participants able to build knowledge-based companies. The pace of innovation will quicken, given the specializations required by the Ford venture and the requirements demanded by the biannual technology change in assembly lines and the incorporation of new advanced manufacturing platforms.

Ford-Hermosillo plant helps to create new local entrepreneurs in different sectors (software, automation, precision machinery, etc.) whose training was gotten on the job in the industry and who did not have connections to wealthy families nor traditional firms in the region (Contreras, 2006). One of the most frequent mechanisms involved companies founded by engineers who were working in Ford. That experience had proved very useful for these new entrepreneurs, not only for the technical and administrative knowledge they acquired but also for the relationships that they built with other employees, managers, and suppliers. According with Contreras (2006) it was possible to identify three principal mechanisms for incorporation of local firms into the

¹⁰ The investment to enlarge the Ford plant and to build a new park of suppliers overcomes the 2,000 million dollars, the biggest investment in the car industry in North American in the last 5 years. All in order to introduce three new models: Ford Fusion, Mercury Milan and Lincoln Zephyr (Contreras, 2006).

automotive sector: spin-off type processes by former Ford employees; Ford's socio-professional networks in the region; and the creation of capacities through conventional market relations. Recently, the U.S.-Mexican Foundation for Sciences and federal and state ministry of economy have been developing a Triple Helix Model for local start ups, and SMEs business accelerators.

4. LESSONS AND RECOMENDATIONS: HAS FDI DEVELOPED A LEARNING PROCESS FOR SMEs?

Subcontracting will be developed to the extent that contractors discover that outsourcing will be more profitable than in-house production. Firms in developed economies have found out that subcontracting is quite profitable in their home countries, when they assume the costs involved in the learning process. The questions that arise are: why don't corporations in developing countries (national as well as transnational) engage in subcontracting? And when they do, why is it on a very limited scale? It is clear that they have not been willing to assume the costs involved, but recently there are trends toward a change in this area that must be analyzed, to find out what has encouraged corporations to engage in subcontracting. FDI has learned that local procurement can be profitable as in the case of Delphi and Ford. The first experience is the way MNCs found it profitable to develop collaborative subcontracting settings through intermediate associations. Other industries have not been able to obtain the level of international standards, that explains why subcontracting has not fully developed, and has rather been viewed as a way of reducing cost experiences, rather than defining a long-term view in which suppliers could become involved in design. But still there are some examples that show a co-evolution pattern. A technological co-evolution exists between clients and suppliers (Lara, Arellano and Garcia, 2005) upon analyzing the value chain in the auto seats industry and of the metal working companies).

Although subsidiaries of MNC firms are an important vehicle for the modernization and development of firms in Mexico, its transnational nature is also an important limitation for a more balanced relationship between foreign and national firms within

regional development. The challenge is still great and needs more research and strategic participation of all the actors involved in this process.

It is important to point out the impact that NAFTA has had in this process. First, stimulate the arrival of FDI in the region. Second, develop the vertical integration in most of the manufacture sectors. Third, stimulate the arrival of foreign suppliers to the region –from a variety of regions. And fourth, propitiate the arrival and creation of SMEs Mexican suppliers. All this aspects has implied the increase of national inputs, as well as to strengthen the industrial cluster. Regional system of innovation is getting importance as well. However, this process has not been reflected yet in the wide diffusion of integration of domestic suppliers, neither in the local entrepreneur capacity. It is necessary the institutional environment so that this process consolidates and gives better results. But local actors seems to abandoned this search and looking for more FDI or local entrepreneurs in other sectors such as biotechnologies, medical products or software.

The circular relationship between public institutions and the institutionalized learning economy requires that the parties to public institutions somehow be convinced of the utility of having a public institution help in supporting the conventions and relationships that make up the institutionalized learning economy. That is, they must share a conviction of the utility of the public institution in some specific domain, before the process can even begin.

Exchanging experiences could become a policy for sustaining the learning process that involves a relationship between public, formal institutions, and conventions and relationships that are neither fully public nor fully formal. There is circularity here: formal public institutions, in creating or sustaining worlds of learning must in effect create or sustain the conventions and relationships of the latter. The question that arises is: how can these exchange systems are sustained? What types of incentives are required? Michael Storper argues that a successful incentive system is itself a convention, which coordinates expectations of performance and reward under conditions of extreme uncertainty. What is true is that small, repeated experimental interactions may be useful for this purpose. Experimentation as a policy device means

actually is getting the parties to work in limited relationships that facilitate learning and then attempting to move up in complexity. It does not mean trying to prove the utility of any general, abstract solution. Most importantly, such experiments must proceed as if confidence existed. Repeated experiences and successes could promote a generalization of experiences, as witnessed in regions of Mexico.

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